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(54) **DISPLAY DEVICE CAPABLE OF SWITCHING IMAGE SOURCES AND OPERATING SYSTEM**

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G06F 3/041 (2006.01)

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CPC ***H04N 5/268*** (2013.01); ***G06F 3/0416*** (2013.01)

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(Continued)

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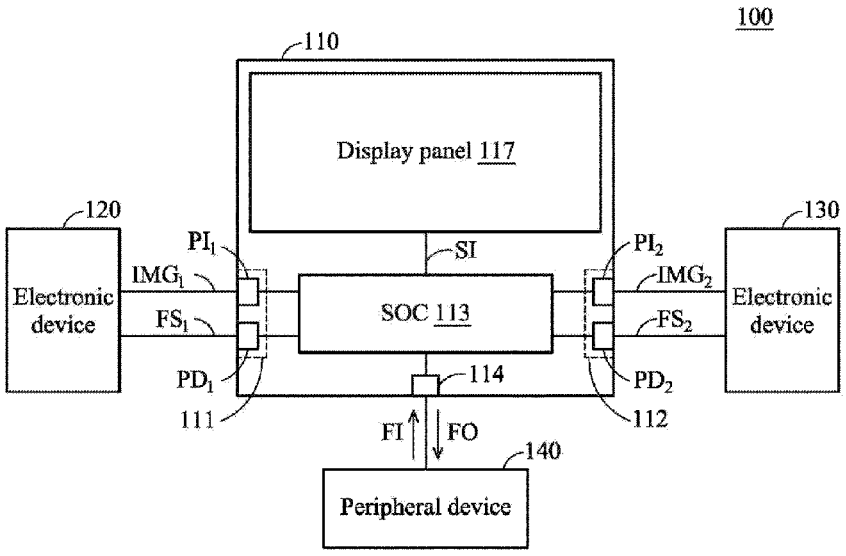
(57) **ABSTRACT**

A display device is capable of switching between image sources and includes a first transmission interface, a second transmission interface, a first peripheral interface, a system on chip (SOC) and a display panel. The first transmission interface is configured to be coupled to a first electronic device and receive a first image signal from the first electronic device. The second transmission interface is configured to be coupled to a second electronic device and receive a second image signal from the second electronic device. The first peripheral interface is configured to be coupled to a first peripheral device providing input information. The SOC selects at least one of the first and second image signals according to the input information to generate a display signal. The display panel displays an image according to the display signal.

20 Claims, 8 Drawing Sheets



(58) **Field of Classification Search**
CPC ... G06F 3/00; G06F 3/02; G06F 3/021; G06F 3/0213; G09G 2340/12; G09G 5/14
USPC 348/564, 563, 705, 706, 584, 598; 345/156, 519, 629, 634, 639, 640; 725/48, 49, 54, 59
See application file for complete search history.

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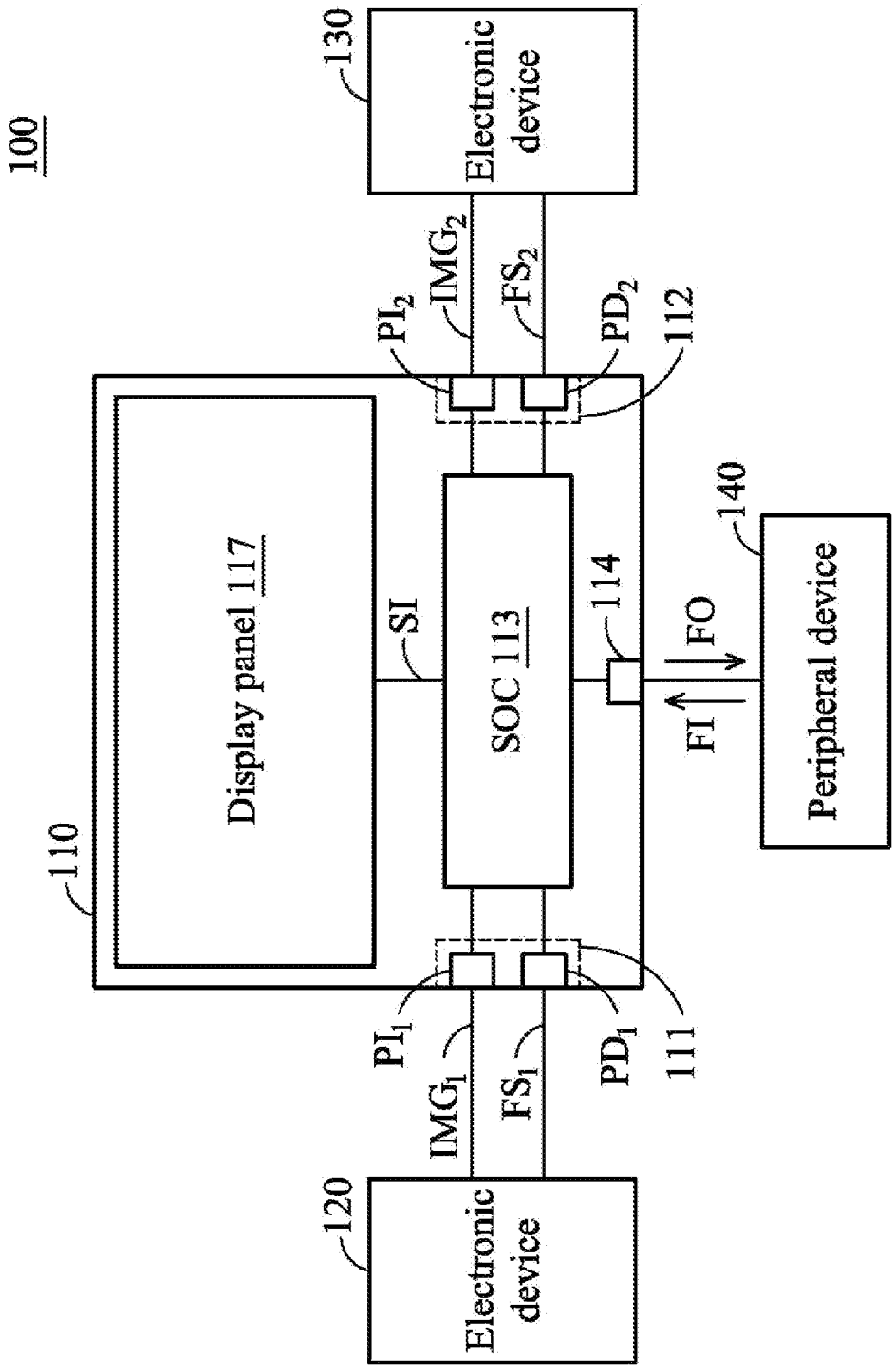
100
130
Electronic device
IMG_2
FS_2
PI_2
PD_2
112
Display panel 117
SI
SOC 113
114
FO
FI
140
Peripheral device
110
PI_1
IMG_1
FS_1
PD_1
111
120
Electronic device

FIG. 1

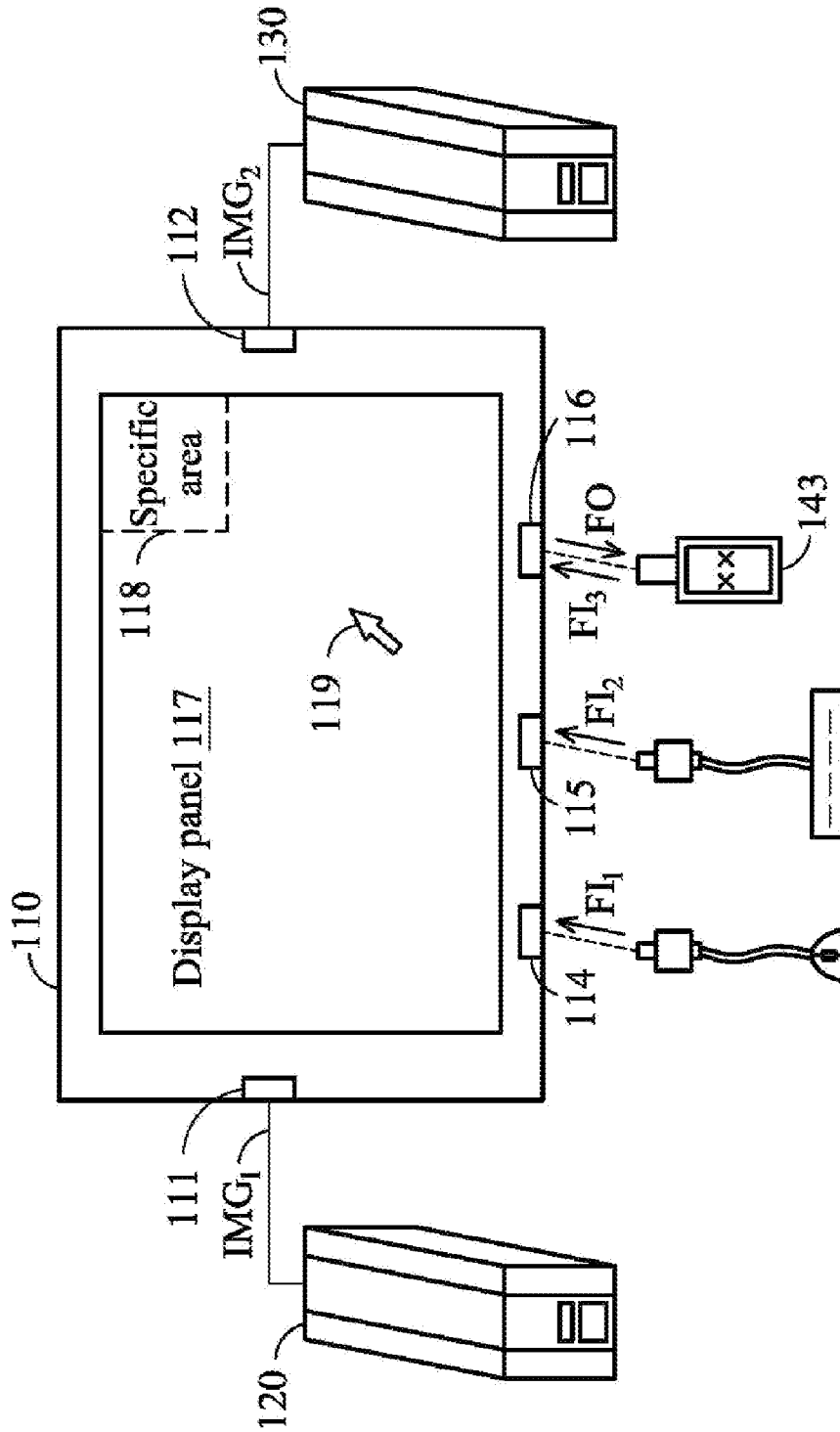
130
IMG_2
112
Specific area
118
Display panel 117
119
110
116
FO
FI_3
143
FI_2
115
142
FI_1
114
141
111
IMG_1
120

FIG. 2

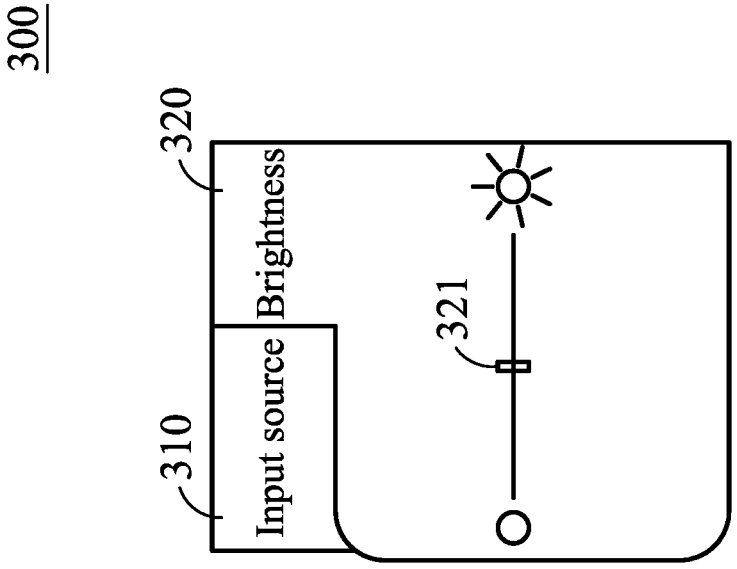
300
320
Brightness
Input source
310
321

FIG. 3B

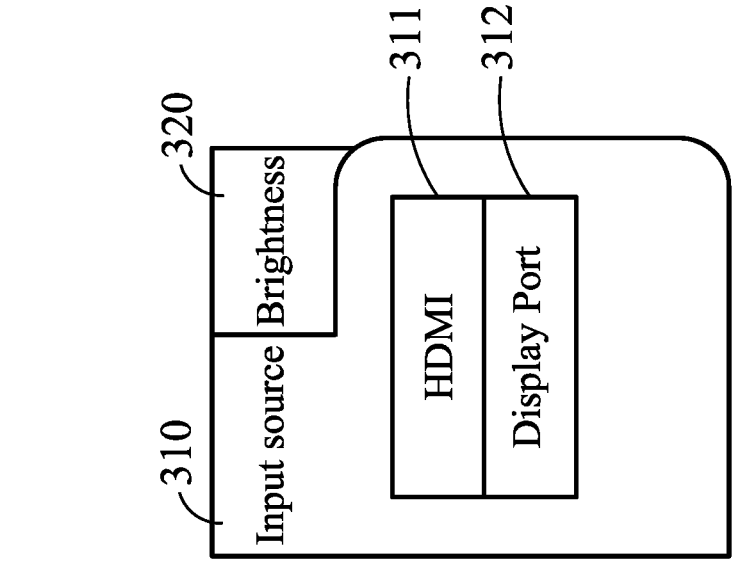
300
320
Brightness
Input source
310
311
312
HDMI
Display Port

FIG. 3A

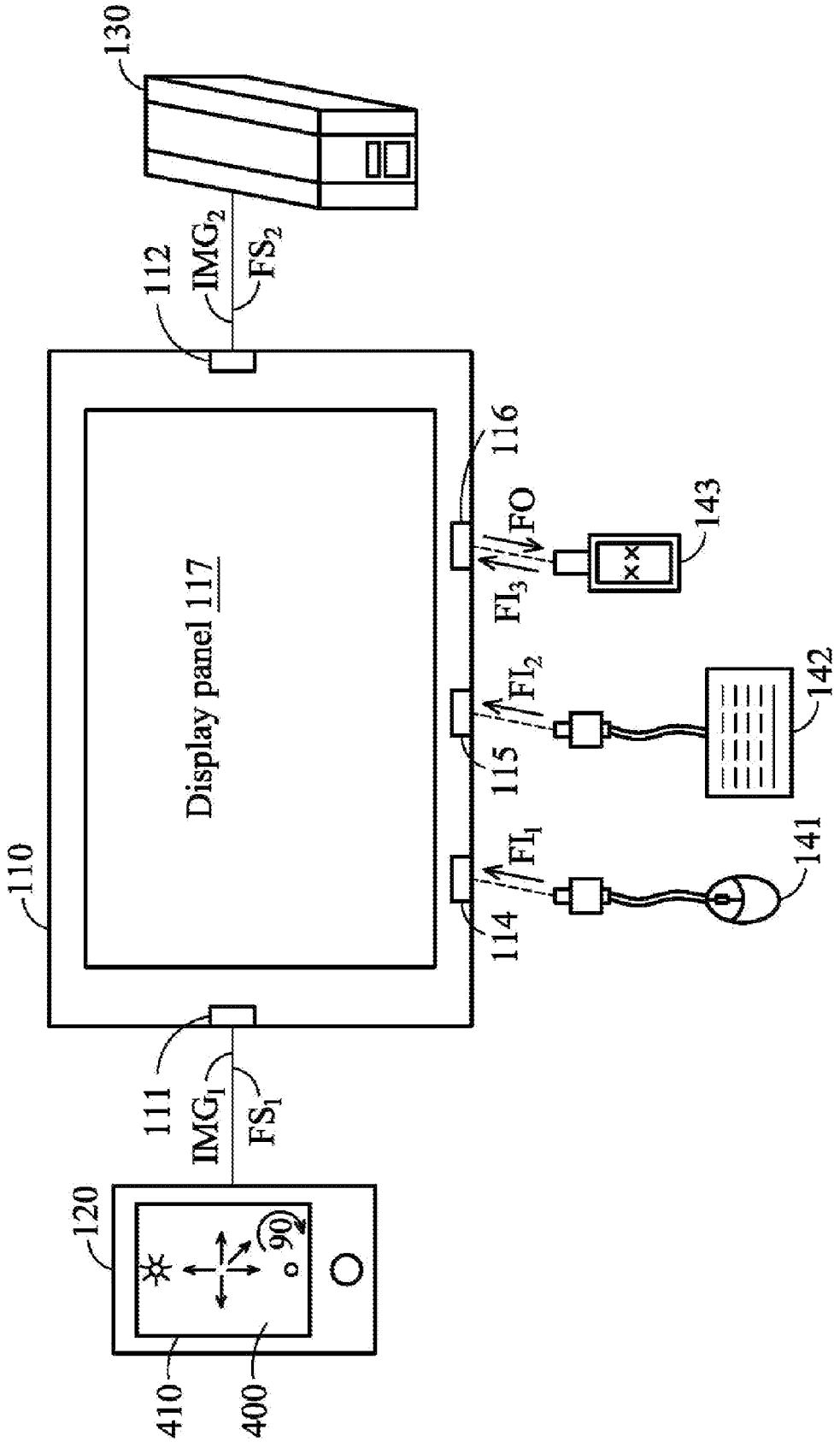
130
112
IMG_2
FS_2
116
FI_3
FO
143
Display panel 117
FI_2
115
142
FI_1
114
141
110
111
IMG_1
FS_1
120
90°
410
400

FIG. 4

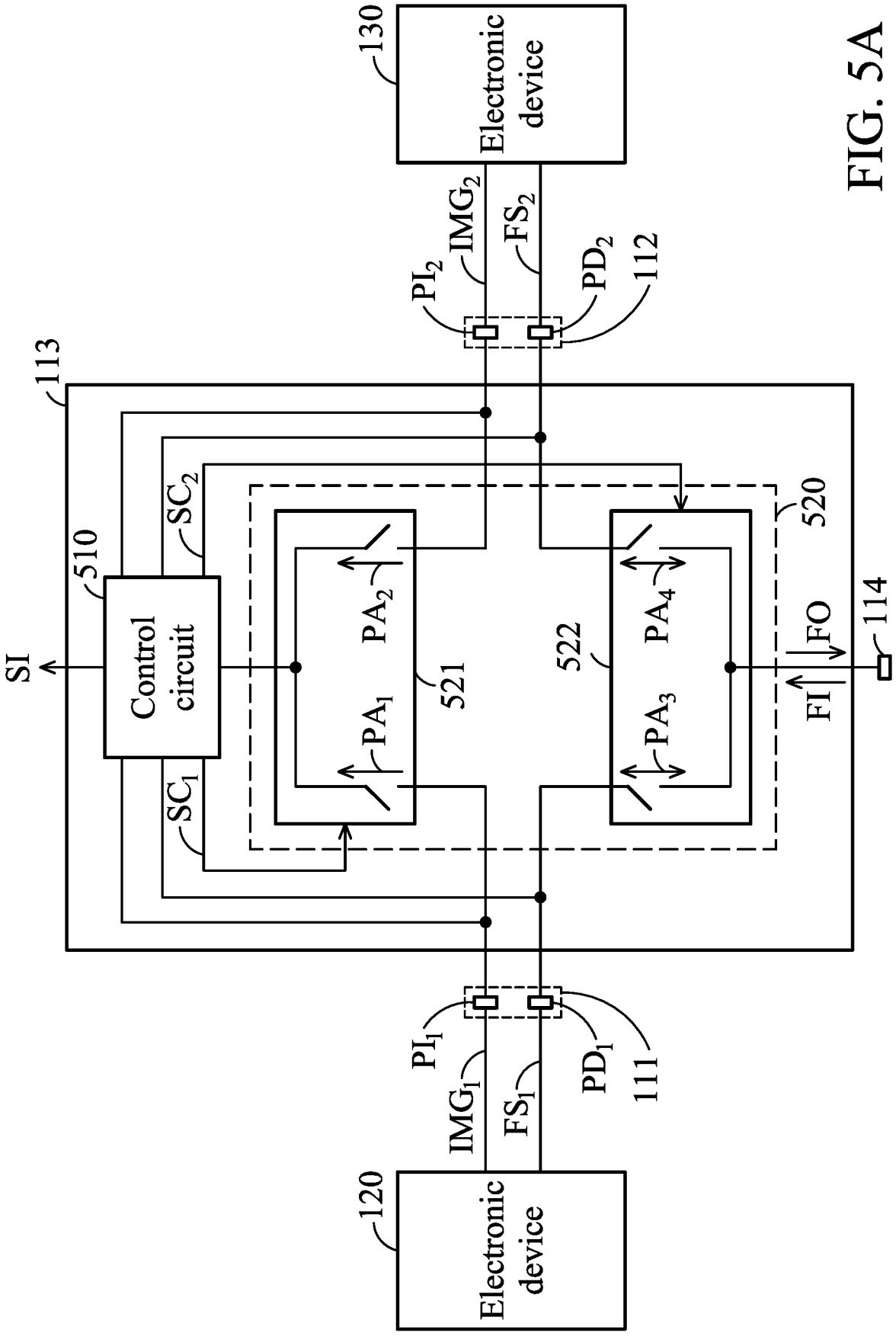
130
Electronic device
IMG_2
FS_2
PI_2
PD_2
112
113
SC_2
510
520
Control circuit
SI
PA_2
PA_4
522
FO
114
PA_1
521
PA_3
FI
SC_1
PI_1
IMG_1
FS_1
PD_1
111
120
Electronic device

FIG. 5A

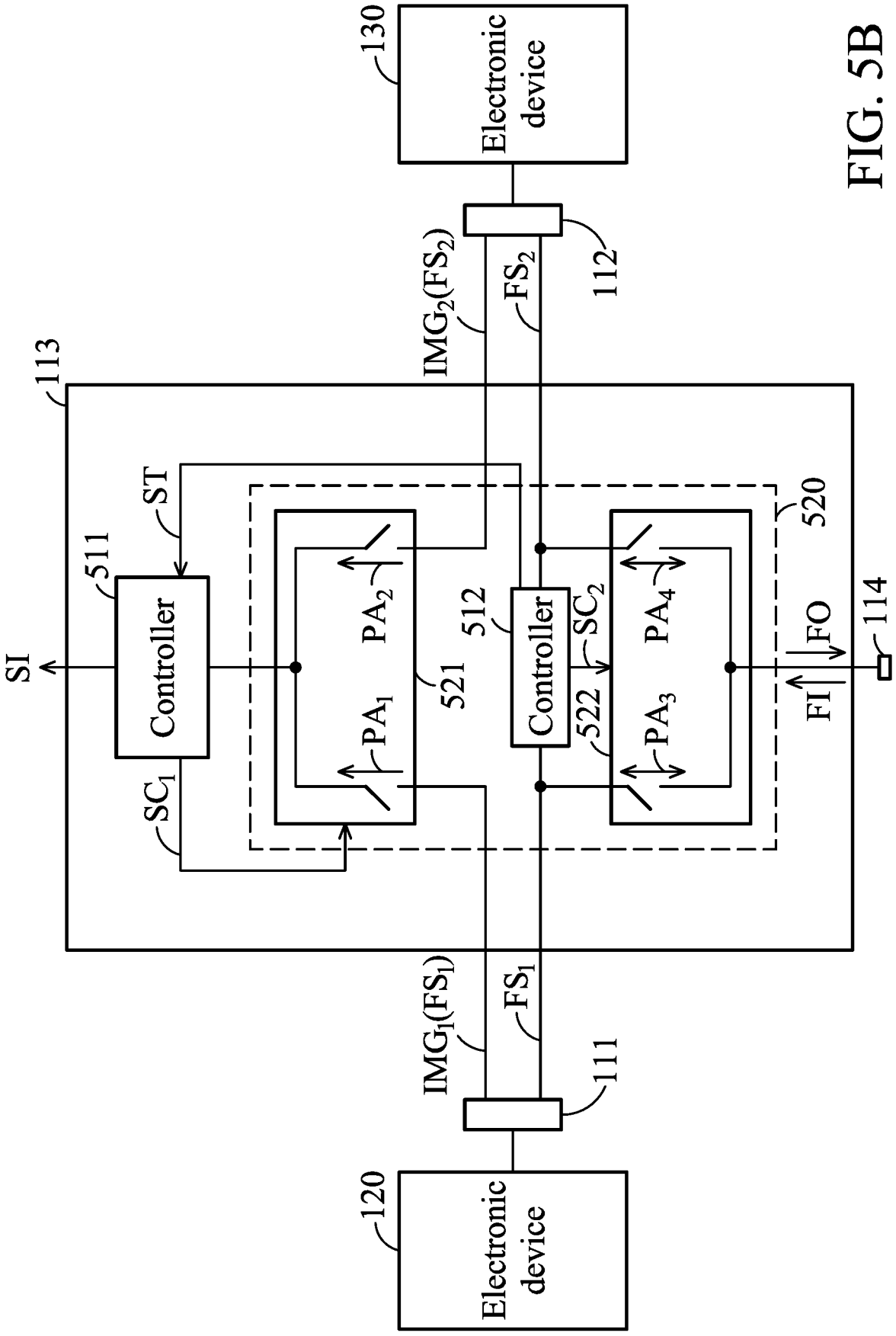
130
Electronic device
112
$IMG_2(FS_2)$
FS_2
113
ST
511
Controller
SI
SC_1
PA_1
PA_2
521
512
Controller
SC_2
PA_3
PA_4
522
520
FI
FO
114
$IMG_1(FS_1)$
FS_1
111
120
Electronic device

FIG. 5B

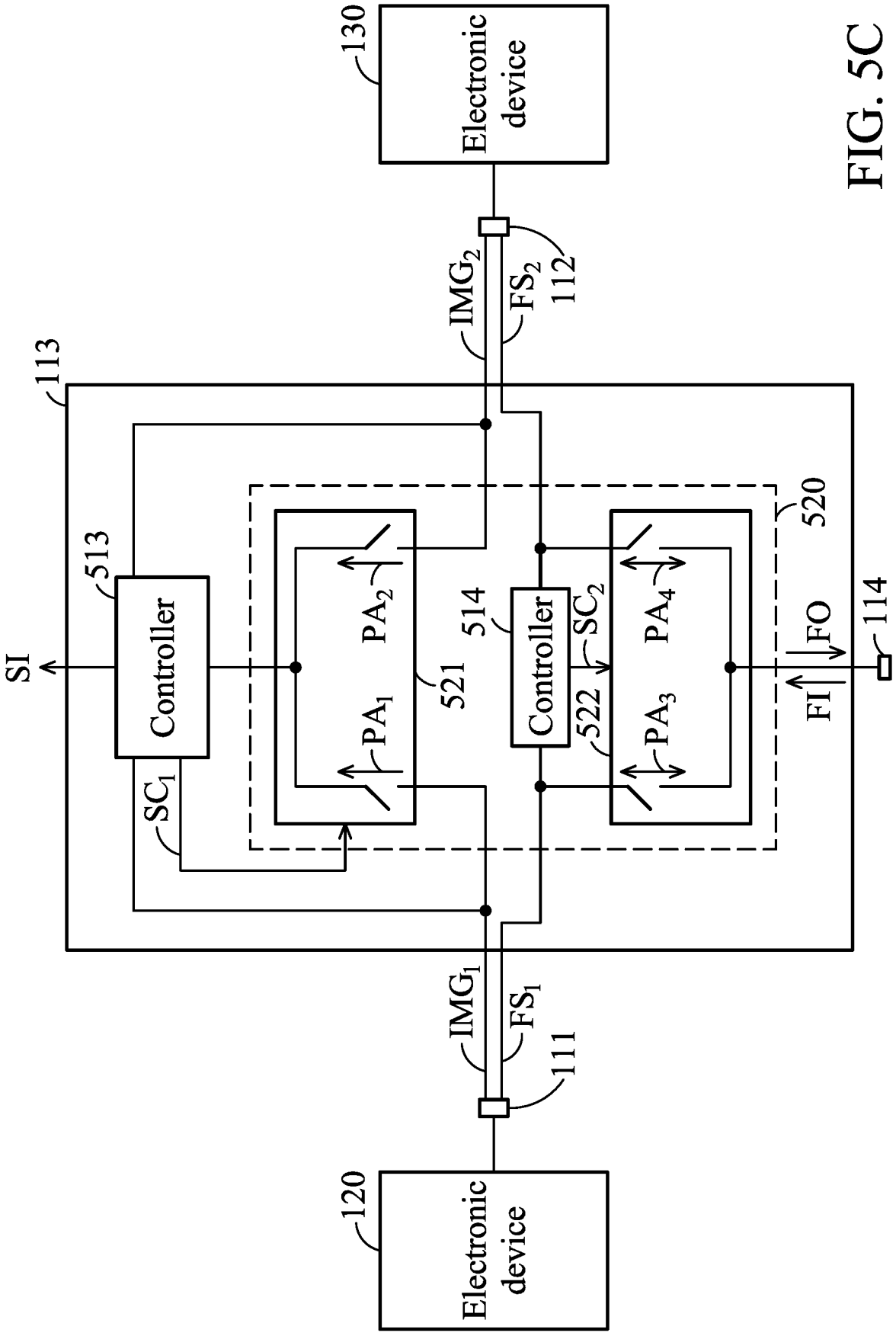
130
Electronic device
IMG2
FS2
112
113
513
Controller
SI
SC1
PA1
PA2
521
514
Controller
SC2
PA3
PA4
522
520
FI
FO
114
IMG1
FS1
111
120
Electronic device

FIG. 5C

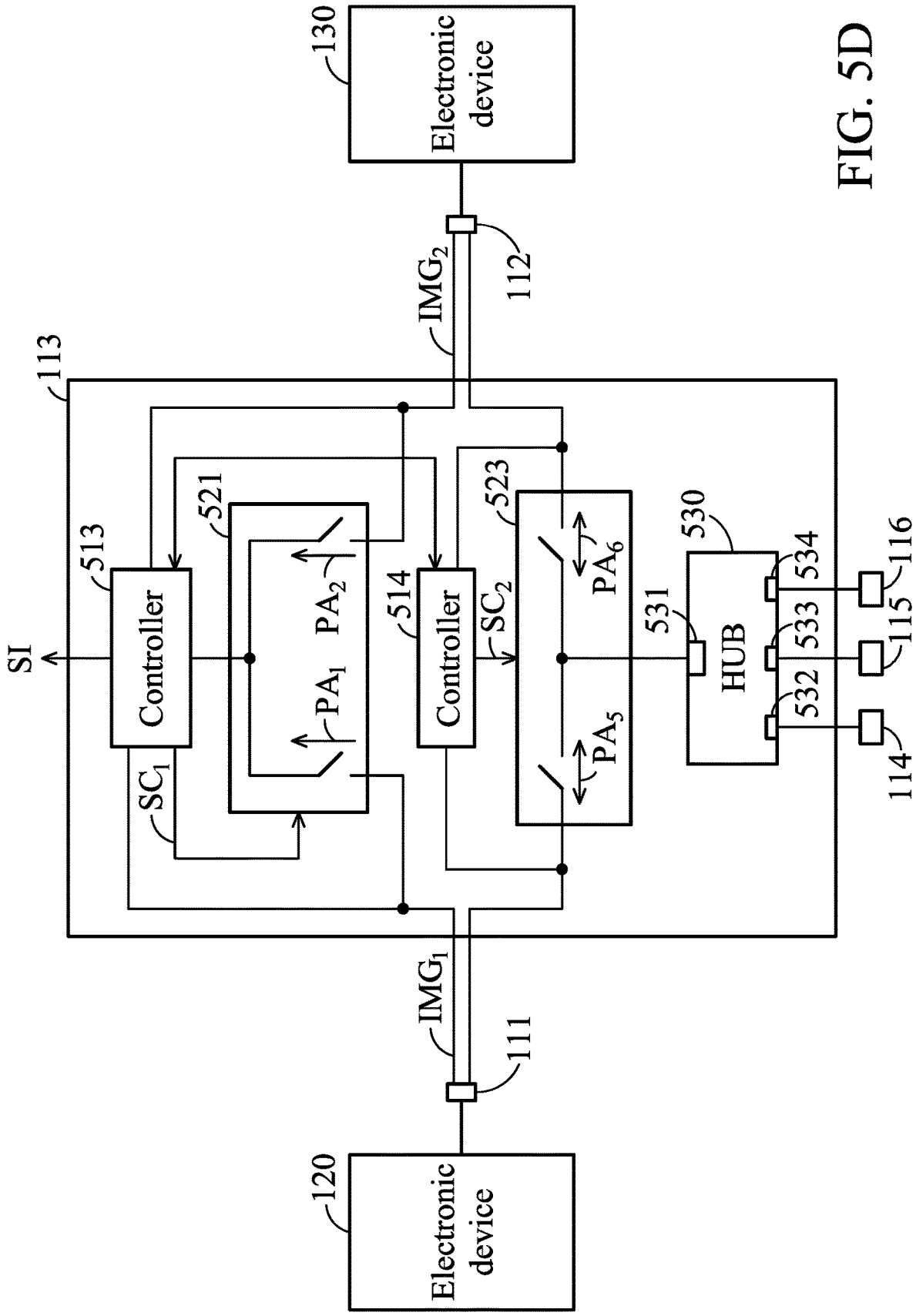
130
Electronic device
112
IMG2
113
521
523
530
513
514
534
116
SI
Controller
PA2
PA1
Controller
SC2
PA6
531
HUB
533
115
SC1
PA5
532
114
IMG1
111
120
Electronic device

FIG. 5D

DISPLAY DEVICE CAPABLE OF SWITCHING IMAGE SOURCES AND OPERATING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This Application claims priority of Taiwan Patent Application No. 108133908, filed on Sep. 20, 2019, the entirety of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a display device, and more particularly to a display device that is capable of switching image sources providing image signals.

Description of the Related Art

Generally, a personal computer typically comprises a display device, a host and many peripheral devices, such as a mouse and a keyboard. Many users have two or more personal computers. When a user needs to use many personal computers, many display devices are turned on and many peripheral devices may be utilized to control the personal computers. Therefore, the inconvenience for the user is increased.

BRIEF SUMMARY OF THE INVENTION

In accordance with an embodiment, a display device is capable of switching image sources and comprises a first transmission interface, a second transmission interface, a first peripheral interface, a system on chip (SOC) and a display panel. The first transmission interface is configured to be coupled to a first electronic device and receive a first image signal from the first electronic device. The second transmission interface is configured to be coupled to a second electronic device and receive a second image signal from the second electronic device. The first peripheral interface is configured to be coupled to a first peripheral device providing input information. The SOC selects at least one of the first and second image signals according to the input information to generate a display signal. The display panel displays an image according to the display signal.

In accordance with another embodiment, an operating system comprises a first electronic device, a second electronic device and a display device. The first electronic device provides a first image signal. The second electronic device provides a second image signal. The display device comprises a first transmission interface, a second transmission interface, a first peripheral interface, a SOC and a display panel. The first transmission interface is configured to be coupled to the first electronic device and receive the first image signal. The second transmission interface is configured to be coupled to the second electronic device and receive the second image signal. The first peripheral interface is configured to be coupled to a first peripheral device providing input information. The SOC selects at least one of the first and second image signals according to the input information to generate a display signal. The display panel displays an image according to the display signal.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more fully understood by referring to the following detailed description and examples with references made to the accompanying drawings, wherein:

FIG. **1** is a schematic diagram of an exemplary embodiment of an operating system, according to various aspects of the present disclosure.

FIG. **2** is a schematic diagram of an exemplary embodiment of a display device, according to various aspects of the present disclosure.

FIG. **3**A is a schematic diagram of an exemplary embodiment of a selection image, according to various aspects of the present disclosure.

FIG. **3**B is a schematic diagram of another exemplary embodiment of the selection image, according to various aspects of the present disclosure

FIG. **4** is a schematic diagram of another exemplary embodiment of the display device, according to various aspects of the present disclosure.

FIG. **5**A is a schematic diagram of an exemplary embodiment of a system on chip, according to various aspects of the present disclosure.

FIG. **5**B is a schematic diagram of another exemplary embodiment of the system on chip, according to various aspects of the present disclosure.

FIG. **5**C is a schematic diagram of another exemplary embodiment of the system on chip, according to various aspects of the present disclosure.

FIG. **5**D is a schematic diagram of another exemplary embodiment of the system on chip, according to various aspects of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be described with respect to particular embodiments and with reference to certain drawings, but the invention is not limited thereto and is only limited by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated for illustrative purposes and not drawn to scale. The dimensions and the relative dimensions do not correspond to actual dimensions in the practice of the invention.

FIG. **1** is a schematic diagram of an exemplary embodiment of an operating system, according to various aspects of the present disclosure. The operating system **100** comprises a display device **100**, electronic devices **120** and **130**, and a peripheral device **140**. In this embodiment, the electronic devices **120** and **130** share the display device **110** and the peripheral device **140**. For example, when the electronic device **120** is coupled to the display device **110**, the display device **110** displays an image according to the image signal IMG_1 provided by the electronic device **120**. At this time, the electronic device **120** receives input information FI from the peripheral device **140** via the display device **110** or sends output information FO to the peripheral device **140** via the display device **110**. When the electronic device **130** is coupled to the display device **110**, the display device **110** displays an image according to the image signal IMG_2 provided by the electronic device **130**. At this time, the electronic device **130** receives input information FI from the peripheral device **140** via the display device **110** or sends output information FO to the peripheral device **140** via the display device **110**.

In other embodiments, when the display device **110** displays an image according to the image signal IMG_1 provided from the electronic device **120**, if the electronic device **130** is coupled to the display device **110**, the display device **110** still displays the image corresponding to the image signal IMG_1 provided from the electronic device **120**.

In some embodiments, after the display device **110** is powered-on, if the display device **110** receives the image signal IMG_1 from the electronic device **120** and the image signal IMG_2 form the electronic device **130**, the display device **110** may select the image signal IMG_1 or IMG_2 according to a predetermined value. For example, if the predetermined value indicates the electronic device **120**, the display device **110** displays an image according to the image signal IMG_1. However, if the predetermined value indicates the electronic device **130**, the display device **110** displays an image according to the image signal IMG_2. In one embodiment, the predetermined value is stored in the display device **110** beforehand.

The types of electronic devices **120** and **130** are not limited in the present disclosure. Any device can serve as the electronic device **120** or **130**, as long as the device is capable of outputting an image signal. In one embodiment, at least one of the electronic devices **120** and **130** is a host device, a flat panel, a notebook computer, or a smartphone.

In other embodiments, if the display device **110** receives the image signal IMG_1 from the electronic device **120** and the image signal IMG_2 from the electronic device **130**, the display device **110** displays a Picture-in-Picture (PIP) image according to the image signals IMG_1 and IMG_2. In one embodiment, if the electronic device **120** is coupled to the display device **110** earlier than the electronic device **130**, the display device **110** displays a main image according to the image signal IMG_1 provided from the electronic device **120** and displays a sub-image in the main image according to the image signal IMG_2 provided from the electronic device **130**. At this time, the electronic device **120** can communicate with the peripheral device **140** via the display device **110**, but the electronic device **130** cannot communicate with the peripheral device **140** via the display device **110**.

In some embodiments, when the display device **110** receives the image signal IMG_1 from the electronic device **120** and receives the image signal IMG_2 from the electronic device **130**, the display device **110** may display two images. The two images have the same size. For example, the display device **110** displays a first image according to the image signal IMG_1 and displays a second image according to the image signal IMG_2, wherein the first image may be located in the left or the right of the second image. In this embodiment, the display device **110** comprises transmission interfaces **111** and **112**, a system on chip (SOC) **113**, a peripheral interface **114** and a display panel **117**.

The transmission interface **111** is configured to the electronic device **120** and receives the image signal IMG_1. The invention is not limited to how the transmission interface **111** receives the image signal IMG_1. In one embodiment, the transmission interface **111** receives the image signal IMG_1 via a transmission cable. In another embodiment, the transmission interface **111** comprises a wireless transceiver (not shown). In this case, the transmission interface **111** utilizes a wireless method to receive the image signal IMG_1.

In this embodiment, the transmission interface **111** comprises an image transmission port PI_1 and a data transmission port PD_1. The image transmission port PI_1 is configured to receive the image signal IMG_1. The data transmission port PD_1 is configured to transmit data. For example, the data transmission port PD_1 may transmit the input information FI to the electronic device **120** or receives the output information FO from the electronic device **120**. In other embodiments, the data transmission port PD_1 may transmit selection information FS_1 generated by the electronic device **120** to the SOC **113**. In such cases, the SOC **113** operates according to the selection information FS_1. For example, the SOC **113** may adjust the display signal SI or send a control signal (not shown) to adjust the state (e.g., brightness) of the display panel **117** according to the selection information FS_1. In other embodiments, the selection information FS_1 may be combined in the image signal IMG_1. Therefore, the data transmission port PD_1 is capable of transmitting the selection information FS_1.

The type of image transmission port PI_1 is not limited in the present disclosure. In one embodiment, the image transmission port PI_1 is a higher definition multimedia interface (HDMI), a display port (DP), a video graphics array (VGA) port, a digital visual interface (DVI) port or a universal serial bus type-c (USB Type-C) port.

In some embodiments, when the image transmission port PI_1 is a USB Type-C port, the USB Type-C port can transmit the image signal IMG_1 and data (e.g., the output information FO, the input information FI or the selection information FS_1). Therefore, the data transmission port PD_1 can be omitted. Additionally, the type of data transmission port PD_1 is not limited in the present disclosure. Any transmission port can serve as the data transmission port PD_1, as long as the transmission port is capable of transmitting data. In one embodiment, the data transmission port PD_1 is a USB port.

The transmission interface **112** is configured to be coupled to the electronic device **130** and receive the image signal IMG_2. In this embodiment, the transmission interface **112** comprises an image transmission port PI_2 and a data transmission port PD_2. The image transmission port PI_2 is configured to receive the image signal IMG_2. The data transmission port PD_2 is configured to transmit data. Since the features of the image transmission port PI_2 and the data transmission port PD_2 are the same as the features of the image transmission port PI_1 and the data transmission port PD_1, the descriptions of the features of the image transmission port PI_2 and the data transmission port PD_2 are omitted.

In some embodiments, the image transmission port PI_2 may be the same or different from the image transmission port PI_1. For example, the image transmission ports PI_1 and PI_2 are HDMI ports. In other embodiments, the image transmission port PI_1 may be a DP port and the image transmission port PI_2 may be a HDMI port. The numbers of transmission interfaces are not limited in the present disclosure. In other embodiments, the display device **110** has more transmission interfaces to receive image signals from different electronic devices.

The peripheral interface **114** is configured to be coupled to the peripheral device **140**. The peripheral interface **114** may utilize a wire method or a wireless method to receive the input information FI generated by the peripheral device **140** or provide the output information FO to the peripheral device **140**. The type of peripheral interface **114** is not limited in the present disclosure. In one embodiment, the peripheral interface **114** comprises a USB port. Additionally, the number of peripheral interfaces is not limited in the present disclosure. In other embodiments, the display device **110** may comprise more or fewer display devices to couple to more or fewer peripheral devices.

The SOC **113** generates a display signal SI according to at least one of the image signals IMG_1 and IMG_2. The display panel **117** displays an image according to the display signal SI. For example, when the electronic device **120** is coupled to the transmission interface **111** and the electronic device **130** is not coupled to the transmission interface **112**, the SOC **113** receives and processes the image signal IMG_1 provided from the electronic device **120** to generate a display signal SI. Therefore, the image displayed on the display panel **117** is controlled by the electronic device **120**.

The invention is not limited to how the SOC **113** processes the image signal IMG_1. In one embodiment, the SOC **113** uses the image signal IMG_1 as the display signal SI. Furthermore, the SOC **113** further turns on a data path (not shown) between the data transmission port PD_1 and the peripheral interface **114** so that the electronic device **120** is capable of receiving the input information FI from the peripheral device **140** or providing the output information FO to the peripheral device **140**. In other embodiments, when the transmission interface **111** comprises a specific transmission port (e.g., a USB Type-C port), the SOC **113** turns on the data path between the data pins of the specific transmission port and the peripheral interface **114**.

When the electronic device **120** is not coupled to the transmission interface **111** and the electronic device **130** is coupled to the transmission interface **112**, the SOC **113** receives and processes the image signal IMG_2 to generate a display signal SI. In one embodiment, the SOC **113** uses the image signal IMG_2 as the display signal SI. At this time, the SOC **113** turns on the data path (not shown) between the data transmission port PD_2 and the peripheral interface **114**. Therefore, the electronic device **130** is capable of receiving the input information FI from the peripheral device **140** or providing the output information FO to the peripheral device **140**.

When the electronic device **120** is coupled to the transmission interface **111** and the electronic device **130** is coupled to the transmission interface **112**, the SOC **113** generates the display signal SI according to a predetermined value. For example, if the predetermined value points to the transmission interface **111**, the SOC **113** generates the display signal SI according to the image signal IMG_1 and turns on the data path between the transmission interface **111** and the peripheral interface **114**. If the predetermined value points to the transmission interface **112**, the SOC **113** generates the display signal SI according to the image signal IMG_2 and turns on the data path between the transmission interface **112** and the peripheral interface **114**. In other embodiments, the SOC **113** receives and combines the image signals IMG_1 and IMG_2 according to the predetermined value. The display panel **170** displays a PIP image according to the combined result (i.e., the display signal SI) provided by the SOC **113** or displays a PBP image which includes two neighbor images of the same size. In this case, only one electronic device (e.g., **120** or **130**) is capable of communicating with the peripheral device **140** via the peripheral interface **114**.

In other embodiments, the SOC **113** may perform a specific operation according to the selection information FS_1 or FS_2 from the electronic device **120** or **130**. The specific operation is to switch a source which provides an image signal. For example, when the SOC **113** generates the display signal SI according to the image signal IMG_1 provided by the electronic device **120**, if the electronic device **120** sends the selection information FS_1, the SOC **113** uses the image signal IMG_2 from the electronic device **130** and generates the display signal SI according to the image signal IMG_2. At this time, the SOC **113** turns off the data path between the electronic device **120** and the peripheral device **140** and turns on the data path between the electronic device **130** and the peripheral device **140**. However, if the electronic device **130** is no coupled to the transmission interface **112**, the SOC **113** may still use the image signal IMG_1 to generate a display signal SI. In one embodiment, the SOC **113** adds a notification image component in the display signal SI for displaying a notification image to notify the user that the electronic device **130** has not been coupled to the transmission interface **112**. In another embodiment, the display panel **117** does not display any image because the SOC **113** does not receive the image signal IMG_2. However, when the electronic device **130** is coupled to the transmission interface **112**, the SOC **113** immediately generates the display signal SI according to the image signal IMG_2.

In other embodiments, the SOC **113** may generate a display signal SI or an additional control signal (not shown) according to the selection information FS_1 or FS_2 sent from the electronic device **120** or **130** to control the state of the display panel **117**. In this case, the brightness or resolution of the display panel **117** may be adjusted. In some embodiments, the SOC **113** may rotate the image displayed on the display panel **117** according to the selection information FS_1 from the electronic device **120** or the selection information FS_2 from the electronic device **130**.

The formats of selection information FS_1 and FS_2 are not limited in the present disclosure. Using the selection information FS_1 as an example, in one embodiment, the selection information FS_1 is combined in the image signal IMG_1. The SOC **113** may encode the image signal IMG_1 to retrieve the selection information FS_1. In such cases, the SOC **113** may select the image source or adjust the display signal SI according to the selection information FS_1.

The disclosure is not limited to when the electronic devices **120** and **130** generate selection information FS_1 and FS_2. Using the electronic device **120** as an example, when a trigger event occurs, the electronic device **120** generates the selection information FS_1 to the SOC **113**. The trigger event may be caused by the peripheral device **140**. For example, assume that the peripheral device **140** is a keyboard. When the user presses a hot-key (e.g., to successively press F2 twice), it means that a trigger event occurs. Therefore, the electronic device **120** generates the selection information FS_1. In another embodiment, the trigger event is caused by the electronic device **120**. For example, assume that the electronic device **120** is a smartphone. In this case, when the user draws a specific pattern on the electronic device **120**, the electronic device **120** sends the selection information FS_1.

FIG. **2** is a schematic diagram of an exemplary embodiment of a display device, according to various aspects of the present disclosure. In this embodiment, each of the electronic devices **120** and **130** is a host and the display device **110** further comprises peripheral interfaces **115** and **116**. Since the features of peripheral interfaces **115** and **116** are the same as the feature of the peripheral interface **114**, the descriptions of the features of the peripheral interfaces **115** and **116** are omitted. In this embodiment, the peripheral interface **114** is coupled to a mouse **141**, the peripheral interface **115** is coupled to a keyboard **142**, and the peripheral interface **116** is coupled to a USB disk **143**.

For brevity, assume that the display device **110** displays an image according to the image signal IMG_1. In this case, when the mouse **141** is moved by the user, the mouse **141** generates input information FI_1. The electronic device **120** adjusts the image signal IMG_1 according to the input information FI_1 to change the position of the cursor **119**. Furthermore, when the keyboard **142** is pressed by the user, the keyboard **142** generates input information FI_2. The electronic device **120** adjusts the image signal IMG_1 according to the input information FI_2 to display the text entered by the user. Additionally, the USB disk **143** may provide input information FI_3 to the electronic device **120** or receive and store output formation FO from the electronic device **120**.

In this embodiment, the display panel **117** has a specific area **118**. When the user moves the cursor **119** to the specific

area **118** via the mouse **141** or the keyboard **142** and the duration of the cursor **119** being at the specific area **118** is equal to a predetermined time (e.g., 3 secs), a selection image is displayed in the specific area **118** so that the user can select the image source. In other embodiments, the specific area **118** displays the selection image when certain buttons, button sequences, or button combinations are activated. For example, when the user presses the F2 key twice in succession, the specific area **118** displays a selection image. In another embodiment, when the user presses the F2 twice in succession on the keyboard **142**, the display device **110** directly changes the image source providing the image signal.

FIGS. **3**A and **3**B are schematic diagrams of exemplary embodiments of a selection image **300**, according to various aspects of the present disclosure. The selection image **300** comprises an input source option **310**. In other embodiments, the selection image **300** has more options or the fewer options so that the user can adjust the state of the display panel **117**, such as the brightness or the resolution or to rotate the image displayed on the display panel **117**.

As shown in FIG. **3**A, when the user clicks the input source option **310**, the image source is changed. For example, when the user clicks the option **311**, the SOC **113** generates the display signal SI to the display panel **117** according to the image signal IMG_1 form the electronic device **120**. At this time, the SOC **113** turns on the data paths between the electronic device **120** and the peripheral interfaces **114~116** and turns off the data paths between the electronic device **130** and the peripheral interfaces **114~116**. If the user clicks the option **312**, the SOC **113** generates the display signal SI to the display panel **117** according to the image signal IMG_2 from the electronic device **130**. At this time, the SOC **113** turns on the data paths between the electronic device **130** and the peripheral interfaces **114-116** and turns off the data paths between the electronic device **120** and the peripheral interfaces **114-116**.

In other embodiments, when the electronic device **130** is not coupled to the transmission interface **112** and the user clicks the option **312**, the SOC **113** still turns on the data paths between the electronic device **120** and the peripheral interfaces **114~116**. Therefore, the SOC **113** continuously generates the display signal SI to the display panel **117** according to the image signal IMG_1. In one embodiment, the SOC **113** may adjust the display signal SI to display a notification image on the display panel **117** so that the user obtains that the electronic device **130** has not been coupled to the transmission interface **112**. In another embodiment, when the electronic device **130** is not coupled to the transmission interface **112** and the user clicks the option **312**, the display panel **117** displays a black image until the electronic device **130** has been coupled to the transmission interface **112**.

In other embodiments, the selection image **300** further comprises a brightness option **320**. In FIG. **3**B, when the user clicks the brightness option **320**, the brightness of the display panel **117** can be adjusted. For example, when the user moves the brightness adjustment axis **321** to the right side, the brightness of the display panel **117** is increased. when the user moves the brightness adjustment axis **321** to the left side, the brightness of the display panel **117** is reduced.

The size of the selection image **300** is not limited in the present disclosure. In one embodiment, when the resolution of the display panel **117** is increased, the icons displayed on the display panel **117** are shrunk. At this time, the size of the selection image **300** is increased so that the user easily clicks the options. When the resolution of the display panel **117** is reduced, the icons displayed on the display panel **117** are enlarged. At this time, the selection image **300** has a small size to avoid the selection image **300** occupying the space of the image displayed on the display panel **117**.

FIG. **4** is a schematic diagram of another exemplary embodiment of the display device, according to various aspects of the present disclosure. In this embodiment, the electronic device **120** is a smartphone and has a touch panel **410**. Additionally, the electronic device **130** is a host. In this case, the transmission interfaces **111** and **112** are USB Type-C ports, but the disclosure is not limited thereto.

When the user activates a switch application program in the electronic device **120**, the touch panel **410** displays a selection image **400** used for the user to switch the source which provides the image signal. In this case, the image displayed on the display panel **117** may synchronize with the selection image **400** of the touch panel **410**. In this embodiment, the electronic device **120** detects the pattern track which is drawn by the user and on the touch panel **410** to generate a detection result. The electronic device **120** provides selection information FS_1 to the display device **110** according to the detection result. The SOC in the display device **110** selects the image source providing the image signal according to the selection information FS_1.

For example, when the finger of the user contacts the touch panel **410** and moves to the right side of the touch panel **410**, the electronic device **120** sends the selection information FS_1. At this time, since the selection information FS_1 matches a first predetermined condition, the display device **110** selects the image signal IMG_2 from the electronic device **130** and displays an image according to the image signal Additionally, the display device **110** turns on the data paths between the transmission interface **112** and each of the peripheral interfaces **114-116**. Therefore, the user can operate the electronic device **130** via the mouse **141** and the keyboard **142**. Furthermore, the electronic device **130** can access the USB disk **143**.

In other embodiments, when the finger of the user contacts the touch panel **410** and moves to the upper side of the touch panel **410**, the electronic device **120** sends the selection information FS_1 according to the user's gesture. In this case, since the selection information FS_1 may match a second predetermined condition, the display device **110** increases the brightness of the display panel **117**. However, the finger of the user contacts the touch panel **410** and moves to a lower side of the touch panel **410**, the display device **110** reduces the brightness of the display panel **117**. In other embodiments, the user utilizes the selection image **400** to adjust the image displayed on the display panel **117**. For example, when the finger of the user contacts the touch panel **410** and moves to the lower right side of the touch panel **410**, the image displayed on the display panel **117** may be rotated 90 degrees to the right side of the display panel **117**.

FIG. **5**A is a schematic diagram of an exemplary embodiment of the SOC **113**, according to various aspects of the present disclosure. The SOC **113** comprises a control circuit **510** and a switch circuit **520**. The control circuit **510** generates control signals SC_1 and SC_2 according to the voltage levels of the transmission interfaces **111** and **112** to control the switch circuit **520**. In one embodiment, the control circuit **510** is a scalar.

In this embodiment, the control circuit **510** determines whether the electronic devices **120** and **130** provide the image signals IMG_1 and IMG_2 according the voltage levels of the image transmission ports PI_1 and PI_2 to generate a determination result. In this case, the control circuit **510**

generates the control signals SC_1 and SC_2 according to the determination result. For example, when the image transmission port PI_1 does not receive the image signal IMG_1, the voltage level of a specific pin of the image transmission port PI_1 is equal to a predetermined value. When the image transmission port PI_1 receives the image signal IMG_1, the voltage level of the specific pin of the image transmission port PI_1 is not equal to the predetermined value. Therefore, the control circuit **510** obtains whether the electronic device **120** or **130** provides the image signal IMG_1 or IMG_2 according to the voltage levels of the specific pins of the image transmission ports PI_1 and PI_2.

In other embodiments, the control circuit **510** receives the selection information FS_1 and FS_2 via the data transmission ports PD_1 and PD_2 and adjusts the control signals SC_1 and SC_2 according to the selection information FS_1 and FS_2. In some embodiments, the control circuit **510** further adjusts the display signal SI according to the selection information FS_1 and FS_2.

The switch circuit **520** is coupled to the transmission interfaces **111** and **112** and turns on at least one of the image path PA_1 between the transmission interface **111** and the control circuit **510** and the image path PA_2 between the transmission interface **112** and the control circuit **510** according to the control signal SC_1. Furthermore, the switch circuit **520** turns on the data path PA_3 between the transmission interface **111** and the peripheral interface **114** or turns on the data path PA_4 between the transmission interface **112** and the peripheral interface **114** according to the control signal SC_2.

The structure of switch circuit **520** is not limited in the present disclosure. In this embodiment, the switch circuit **520** comprises a switch module **521**. The switch module **521** controls the image paths PA_1 and PA_2 according to the control signal SC_1. The image path PA_1 is coupled between the transmission interface **111** and the control circuit **510**. The image path PA_2 is coupled between the transmission interface **112** and the control circuit **510**.

When the control signal SC_1 matches a first state (e.g., the level of the control signal SC_1 is at a first voltage), the switch module **521** turns on the image path PA_1 and turns off the image path PA_2. Therefore, the image path PA_1 transmits the image signal IMG_1 to the control circuit **510**. When the control signal SC_1 matches a second state (e.g., the level of the control signal SC_1 is at a second voltage), the switch module **521** turns on the image path PA_2 and turns off the image path PA_1. Therefore, the image path PA_2 transmits the image signal IMG_2 to the control circuit **510**. In other embodiments, when the control signal SC_1 matches a third state (e.g., the level of the control signal SC_1 is at a third voltage), the switch module **521** turns on the image paths PA_1 and PA_2 to transmit the image signals IMG_1 and IMG_2 to the control circuit **510**.

In other embodiments, the switch circuit **520** further comprises a switch module **522**. The switch module **522** controls the data paths PA_3 and PA_4 according to the control signal SC_2. The data path PA_3 is coupled between the transmission interface **111** and the peripheral interface **114**. The data path PA_4 is coupled between the transmission interface **112** and the peripheral interface **114**.

When the control signal SC_2 matches a first state (e.g., the level of the control signal SC_2 is at a first voltage), the switch module **522** turns on the data path PA_3. Therefore, the electronic device **120** can receive the input information FI from the peripheral interface **114** or provide the output information FO to the peripheral interface **114**. When the control signal SC_2 matches a second state (e.g., the level of the control signal SC_2 is at a second voltage), the switch module **522** turns on the data path PA_4. Therefore, the electronic device **130** can receives the input information FI form the peripheral interface **114** or provide the output information FO to the peripheral interface **114**.

For brevity, FIG. **5**A only shows the electronic devices **120** and **130**. Therefore, the switch module **522** provides two data paths (e., PA_3 and PA_4). In other embodiments, when the SOC **113** is coupled to more electronic devices, the switch module **522** provides more data paths. Additionally, the switch circuit **520** may comprise more switch modules **522**. In this case, each switch module **522** is coupled between a peripheral interface **114** and many electronic devices.

FIG. **5**B is a schematic diagram of another exemplary embodiment of the SOC **113**, according to various aspects of the present disclosure. In this embodiment, the SOC **113** comprises controllers **511**, **512** and the switch modules **521** and **522**. The controller **511** generates the control signal SC_1 according to a trigger signal ST to direct the switch module **521** to output at least one of the image signals IMG_1 and IMG_z. In some embodiments, the controller **511** decodes the image signal IMG_1 or IMG_2 to obtain the selection information FS_1 or FS_2 and adjusts the display signal SI according to the selection information FS_1 or FS_2.

The controller **512** detects the voltage levels of the image pins of the transmission interfaces **111** and **112** to determine whether the electronic devices **120** and **130** provide the image signals IMG_1 and IMG_2 and generates the trigger signal ST and the control signal SC_2 according to the determination result. For example, when the electronic device **120** is coupled to the transmission interface **111**, the controller **512** generates the trigger signal ST to notify the controller **511**. In this case, the controller **511** generates the control signal SC_1 to direct the switch module **521** to turn on the image path PA_1. At this time, the switch module **521** turns off the image path PA_2. Additionally, the controller **512** utilizes the control signal SC_2 to direct the switch module **522** to turn on the data path PA_3 and turn off the data path PA_4. Therefore, the electronic device **120** receives the input information FI from the peripheral interface **114** or provides the output information FO to the peripheral interface **114** via the data path PA_3.

In other embodiments, when the electronic device **130** is coupled to the transmission interface **111**, the controller **512** utilizes the trigger signal ST to notify the controller **511**. Therefore, the controller **511** directs the switch module **521** to turn on the image path PA_2. At this time, the switch module **521** turns off the image path PA_1. Furthermore, the controller **512** utilizes the control signal SC_2 to direct the switch module **522** to turn on the data path PA_4 and turn off the data path PA_3. Therefore, the electronic device **130** receives the input information FI from the peripheral interface **114** or provides the output information FO to the peripheral interface **114** via the data path PA_4.

In one embodiment, the controller **511** and the switch module **521** are integrated into a first integrated circuit (IC). In this case, the controller **512** and the switch module **522** are integrated into a second IC. The first IC and second IC operate independently. In another embodiment, the controller **512** receives the selection information FS_1 or FS_2 and provides the selection information FS_1 or FS_2 to the controller **511** via another transmission line (not shown).

FIG. **5**C is a schematic diagram of another exemplary embodiment of the SOC **113**, according to various aspects of the present disclosure. FIG. **5**C is similar to FIG. **5**B except that the controller **513** detects the voltage levels of the image

pins of the transmission interfaces **111** and **112** to determine whether the transmission interfaces **111** and **112** receive the image signals. Using the transmission interface **111** as an example, when the voltage level of the image pin of the transmission interface **111** is not equal to an initial value, it means that the transmission interface **111** has received the image signal IMG_1. Therefore, the controller **513** uses the control signal SC_1 to direct the switch module **521** to turn on the image path PA_1. At this time, the switch module **521** may turn off the image path PA_2. In other embodiments, if the transmission interface **111** receives the image signal IMG_1 and the transmission interface **112** receives the image signal IMG_2, the controller **513** may use the control signal SC_1 to direct the switch module **521** to turn on the image paths PA_1 and PA_2.

In other embodiments, the controller **530** determines that the transmission interface **111** has received the image signal IMG_1, the controller **530** triggers the controller **514** so that the controller **514** uses the control signal SC_2 to direct the switch module **52***s* to turn on the data path PA_3. Similarly, when the controller **513** determines that the transmission interface **112** has received the image signal IMG_2, the controller **513** triggers the controller **514** so that the controller **514** uses the control signal SC_2 to direct the switch module **522** to turn on the data path PA_4. In some embodiments, when the controller **513** determines that the transmission interface **111** has received the image signal IMG_1 and the transmission interface **112** has received the image signal IMG_2, the controller **513** directs the controller **514** to turn on the data path PA_3 or PA_4 according to a predetermined value. In this embodiment, the controller **514** provides the selection information FS_1 and FS_2 from the electronic devices **120** and **130** to the controller **513**. The controller **513** adjusts the display signal SI according to the selection information FS_1 or FS_2.

FIG. **5**D is a schematic diagram of another exemplary embodiment of the SOC **113**, according to various aspects of the present disclosure. FIG. **5**D is similar to FIG. **5**C except that the switch module **523** is coupled between the controller **514** and a hub **530**. The hub **530** has an upstream port (UFP) **531** and downstream ports (DFPs) **532**~**534**. The UFP **531** is coupled to the switch module **523**. The DFP **532** is coupled to the peripheral interface **114**. The DFP **533** is coupled to the peripheral interface **115**. The DFP **534** is coupled to the peripheral interface **116**. The switch module **523** provides data paths PA_5 and PA_6. The data path PA_5 is coupled between the transmission interface **111** and the UFP **531**. The data path PA_6 is coupled between the transmission interface **112** and the UFP **531**.

When the electronic device **120** is coupled to the transmission interface **111**, the controller **513** triggers the controller **514**. The controller **514** utilizes the control signal SC_2 to direct the switch module **523** to turn on the data path PA_5. At this time, the switch module **522** turns off the data path PA_6.

When the electronic device **130** is coupled to the transmission interface **112**, the controller **514** sends the control signal SC_2. The switch module **523** turns on the data path PA_6 and turns off the data path PA_5 according to the control signal SC_2.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). For example, it should be understood that the system, device and method may be realized in software, hardware, firmware, or any combination thereof. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A display device capable of switching image sources, comprising:

a first transmission interface configured to be coupled to a first electronic device and receive a first image signal from the first electronic device;

a second transmission interface configured to be coupled to a second electronic device and receive a second image signal from the second electronic device;

a first peripheral interface configured to be coupled to a first peripheral device providing input information;

a system on chip (SOC) selecting at least one of the first and second image signals according to the input information to generate a display signal; and

a display panel displaying an image according to the display signal,

wherein:

the second transmission interfaces is a USB Type-C connector, and

the USB Type-C connector transmits first output information from the second electronic device to the first peripheral device and transmits the input information from the first peripheral device to the second electronic device.

2. The display device capable of switching image sources as claimed in claim **1**, wherein in response to the SOC selecting the first image signal to generate the display signal:

the first electronic device receives the input information via the first transmission interface and generates selection information according to the input information, and

the SOC receives the selection information via the first transmission interface and directs the display panel to display a selection image according to the selection information.

3. The display device capable of switching image sources as claimed in claim **2**, wherein in response to a specific option of the selection image being clicked, the SOC performs a specific operation.

4. The display device capable of switching image sources as claimed in claim **3**, wherein the specific operation is to generate the display signal according to the second image signal and to turn on a data path between the first peripheral interface and the second transmission interface.

5. The display device capable of switching image sources as claimed in claim **3**, wherein the specific operation is to adjust the brightness of the display panel or to adjust the resolution of the display panel.

6. The display device capable of switching image sources as claimed in claim **2**, wherein:

the display panel has a specific area to display the selection image, and the selection image has a first option and a second option,

in response to the first option being clicked, the SOC generates the display signal according to the first image signal,

in response to the second option being clicked, the SOC generates the display signal according to the second image signal, and

in response to a cursor being moved to the specific area and the duration which the cursor is at the specific area in being equal to a predetermined time, the selection image is displayed in the specific area.

7. The display device capable of switching image sources as claimed in claim **6**, wherein the selection image further has a third option, and in response to the third option being clicked, the SOC adjusts the brightness of the display panel.

8. The display device capable of switching image sources as claimed in claim **1**, wherein the SOC comprises:

a control circuit generating a control signal according to voltage levels of the first and second transmission interfaces; and

a switch circuit coupled to the first and second transmission interfaces to receive the first and second image signals and outputting at least one of the first and second image signals to the control circuit according to the control signal so that the control circuit generates the display signal according to at least one of the first and second image signals.

9. The display device capable of switching image sources as claimed in claim **8**, wherein:

in response to the switch circuit providing the first image signal to the control circuit, the switch circuit provides the input information to the first electronic device via the first transmission interface, and

in response to the switch circuit providing the second image signal to the control circuit, the switch circuit provides the input information to the second electronic device via the second transmission interface.

10. The display device capable of switching image sources as claimed in claim **9**, further comprising:

a second peripheral interface configured to be coupled to a second peripheral device,

wherein in response to the switch circuit providing the first image signal to the control circuit and the first electronic device providing second output information to the first transmission interface, the switch circuit provides the second output information to the second peripheral device.

11. The display device capable of switching image sources as claimed in claim **10**, further comprising:

a hub comprising an upstream port, a first downstream port and a second downstream port, wherein the upstream port is coupled to the switch circuit, the first downstream port is coupled to the first peripheral interface, and the second downstream port is coupled to the second peripheral interface.

12. The display device capable of switching image sources as claimed in claim **1**, wherein the first transmission interfaces is a USB Type-C connector.

13. The display device capable of switching image sources as claimed in claim **1**, wherein the first transmission interface comprises a first image transmission port to receive the first image signal, the second transmission interface comprises a second image transmission port to receive the second image signal, and the type of the first image transmission port is different from the type of the second image transmission port or the same as the type of the second image transmission port.

14. The display device capable of switching image sources as claimed in claim **1**, wherein:

in response to the first transmission interface being coupled to the first electronic device and the second transmission interface not being coupled to the second electronic device, the SOC provides the first image signal as the display signal, and

in response to the first transmission interface not being coupled to the first electronic device and the second transmission interface being coupled to the second electronic device, the SOC provides the second image signal as the display signal.

15. The display device capable of switching image sources as claimed in claim **1**, wherein in response to the first transmission interface being coupled to the first electronic device, the second transmission interface being coupled to the second electronic device, and the first peripheral interface not receiving the input information from the first peripheral device, the SOC provides the first or second image signal as the display signal according to a predetermined value.

16. The display device capable of switching image sources as claimed in claim **1**, wherein in response to the first transmission interface being coupled to the first electronic device, the second transmission interface being coupled to the second electronic device, and the first peripheral interface not receiving the input information from the first peripheral device, the SOC combines the first and second image signals to generate a third image signal and the display panel displays a Picture-in-Picture (PIP) according to the third image signal.

17. An operating system comprising:

a first electronic device providing a first image signal;

a second electronic device providing a second image signal; and

a display device comprising:

a first transmission interface configured to be coupled to the first electronic device and receive the first image signal;

a second transmission interface configured to be coupled to the second electronic device and receive the second image signal;

a first peripheral interface configured to be coupled to a first peripheral device providing input information;

a system on chip (SOC) selecting at least one of the first and second image signals according to the input information to generate a display signal; and

a display panel displaying an image according to the display signal,

wherein:

the second transmission interfaces is a USB Type-C connector, and

the USB Type-C connector transmits first output information from the second electronic device to the first peripheral device and transmits the input information from the first peripheral device to the second electronic device.

18. The operating system as claimed in claim **17**, wherein in response to the SOC selecting the first image signal to generate the display signal:

the first electronic device receives the input information via the first transmission interface and generates selection information according to the input information, and

the SOC receives the selection information via the first transmission interface and directs the display panel to display a selection image according to the selection information.

19. The operating system as claimed in claim **18**, wherein:

in response to a first option of the selection image being clicked, the SOC generates the display signal according to the first image signal, and

in response to a second option of the selection image being clicked, the SOC generates the display signal according to the second image signal.

20. The operating system as claimed in claim **19**, wherein in response to a third option of the selection image being clicked, the SOC adjusts the brightness of the display panel.

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